Reference

Bouwsema H, van der Sluis C, Bongers R

Center for Human Movement Sciences, University of Groningen, Groningen

Movement characteristics of upper extremity prostheses during basic goal-directed tasks

Clinical Biomechanics 2010; 25: 523–529

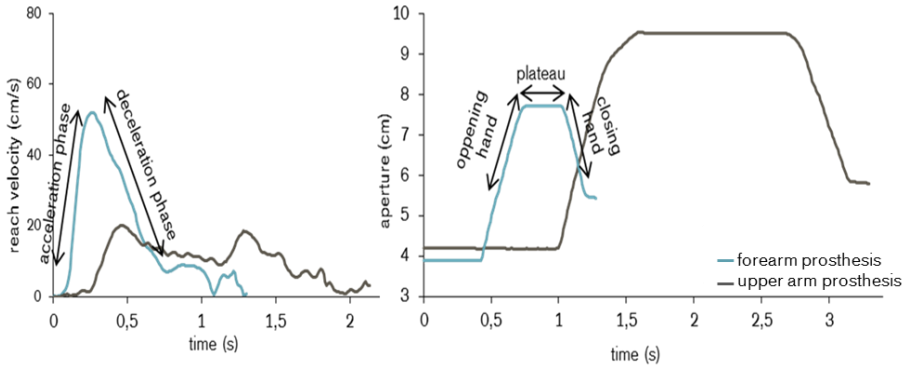
Products

Digital Twin hand

Major Findings

- → **Reaching and grasping of an object with the prosthesis is slower with a plateau phase than in able bodied persons.**
- → **The forearm amputees require less time to pick up an object than the upper arm amputees.**
- → **Training should focus on timing between hand opening and hand closing.**
- → **During training amputee should pay attention to simultaneous finish reaching and start grasping an object.**

Reaching and grasping movements for forearm and upper arm amputees:



The forearm prostheses required less time to execute the reach than the upper arm prostheses. Grasp time and plateau phase were shorter for the upper arm prostheses.

Population

Subjects:	3 forearm and 3 upper arm amputees
Previous:	forearm amputees used myoelectric prostheses with Digital Twin hands upper arm amputees used hybrid prostheses = mechanical elbow + myoelectric prostheses with Digital Twin hands
Amputation causes:	n.a.
Mean age:	45 ± 11 years
Mean time since amputation:	14 ± 12 years

Study Design

Observational (non-interventional) study:

Movements from six users of upper extremity prostheses were analysed, three participants with a hybrid upper arm prosthesis, and three participants with a myoelectric forearm prosthesis. Three tasks were investigated: direct grasping task – participants reached out for and grasped an object positioned on the table in front of them with their prosthetic hand; the indirect grasping task – participants handed an object over from their sound hand to the prosthetic hand; the pointing task – partici-

pants made horizontal back and forth movements between two vertical bars, with a stylus held in their prosthetic hand.

Results

Body Function		Activity			Participation	Others	
Mechanics	**Pain**	**Grip patterns / force**	**Manual dexterity**	**Activities of daily living (ADL)**	**Satisfaction and Quality of life (QoL)**	**Training**	**Technical aspect**

Category	Outcomes	Results for movement characteristics of forearm and upper arm amputees	Sig.*
Mechanics	Grasping	**The forearm prosthetic users required less time to reach an object.**	**++**
		The forearm prosthetic user needed less time to grasp an object.	**++**
		The plateau phase (time between opening and closing the hand) is shorter for forearm prosthetic users.	0

* no difference (0), positive trend (+), negative trend (–), significant (++/––), not applicable (n.a.)

Author's Conclusion

"By characterizing movements with upper extremity prostheses, specific deviations have been pinpointed between two types of prostheses and between prostheses and existing knowledge of able-bodied behaviour. Developments in technology and rehabilitation should focus on these issues to increase the use of prostheses, in particular on improving motor characteristics and the control of the elbow, and learning to coordinate the reach and the grasp component in prehension." (Bouwsema et al. 2010)